(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

特開平11－181408

(43)公開日　平成11年(1999)７月６日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｃ０９Ｋ　3/14	５５０	Ｃ０９Ｋ　3/14	５５０Ｆ
			５５０Ｄ
			５５０Ｅ
			５５０Ｊ

審査請求　未請求　請求項の数３　ＯＬ　（全　４　頁）

(21)出願番号　特願平9－356524

(22)出願日　平成９年(1997)12月25日

(71)出願人　000158828
輝化学工業株式会社
兵庫県神戸市須磨区寺田町３丁目１番８号

(72)発明者　山本　力
兵庫県神戸市灘区五毛通１丁目１番11号

(72)発明者　吉田　将展
兵庫県明石市沢野１丁目16番１号

(74)代理人　弁理士　中尾　充

(54)【発明の名称】　研磨液及び研磨方法

(57)【要約】
【課題】表面粗さがナノメータないしはオングストロームオーダーの平滑面高精度の鏡面加工の能率と精度とを向上する手段。
【解決手段】０．１ないし１０重量％の研磨剤と、０．１ないし１０重量％の滑剤と、３ないし４０重量％の潤滑調整剤とを水または油脂剤に分散、混合してなることを特徴とする研磨液を提供する。滑剤としては、雲母、グラファイト、タルク、六方晶系窒化硼素、または弗素樹脂の中のいずれか１種または２種以上の微粉が好ましく用いられる。電子工学をはじめ、機械工学、光学などの分野で極めて精度の高い鏡面加工、例えば、ＬＳＩ用シリコン、ＶＴＲのヘッド、高出力レーザ用鏡などの加工に好適である。

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【特許請求の範囲】

【請求項１】０．１ないし１０重量％の研磨剤と、０．１ないし１０重量％の滑剤と、３ないし４０重量％の潤滑調整剤とを水または油脂剤に分散、混合してなることを特徴とする研磨液。

【請求項２】滑剤が、雲母、グラファイト、タルク、六方晶系窒化硼素および弗素樹脂の中のいずれか１種または２種以上の微粉であることを特徴とする請求項１記載の研磨液。

【請求項３】研磨剤および潤滑調整剤に、０．１ないし１０重量％の滑剤が添加され、水または油脂剤に分散、混合して研磨液を用い、研磨することを特徴とする研磨方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、極めて精度の高い平滑面を形成するための仕上研磨もしくは中間研磨に使用する研磨液及び研磨方法に関する。さらに詳しくは、鏡面として使用するガラス、アルミニウム、銅、ステンレス鋼、フェライト、シリコン、炭化珪素、セラミックスなどの表面を能率的に研磨して、高精度の鏡面を形成するために使用する研磨液及び研磨方法に関する。

【０００２】

【従来の技術】最近の技術進歩により、電子工学をはじめ、機械工学、光学などの技術、学術分野では、極めて精度の高い、具体的には表面粗さ（Ｒａ）がナノメータないしはオングストロームオーダーの平滑面が要求されるようになった。これらの平滑面のほとんどは研磨剤を用いたラッピング、ポリシングやバフなどの研磨加工によって鏡面に仕上げられている。例えば、ピッチ、錫、半田合金、ポリシングクロスなどの比較的柔らかい素材を定盤として用い、被研磨面と定盤との間にダイヤモンド微粒子、アルミナ微粒子等の研磨剤を分散した研磨液を挿入して研磨するラッピングがあげられる。

【０００３】

【発明が解決しようとする課題】前記のラッピングでは、定盤の精度が高く保たれている研磨の初期段階では、被研磨素材表面と定盤面とは密着して研磨されているが、被研磨面が硬く定盤面が柔らかいので研磨の進行とともに、定盤面が次第に変形をはじめる。定盤が変形すると被研磨面が密着しなくなって研磨が不均一になり、そのまゝ研磨を続けても精度の高い研磨面に加工できないので、一旦研磨を中止し、定盤を取り外して表面を再修正（再生と言う）しなければならない。このようにして再生した定盤を元どおりに取り付け、研磨を再開する作業を何回となく繰り返し、目的の鏡面に加工している。そのために時間を掛けた割りには研磨量が少なく、加工能率が悪いという問題があった。

【０００４】加えて、時間当りの研磨量を多くするには、粒子径の大きい研磨剤を用いればよいが、粒子径が

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大きいと被研磨面に粒子による擦過傷が発生し、しかも粒子径が大きいほど深く大きな擦過傷になるので、最初は粒子径の大きな研磨剤を用いて大きな凹凸を早く研磨、除去し、ついで次第に使用する研磨剤の粒径を小さくしながら研磨を進め、研磨剤により生じた擦過傷などを研磨し消し去る必要がある。これらの作業のために高精度の鏡面に仕上げるのには長い加工時間を要し加工能率を低いものにしていた。本発明は、前記の問題を解決し、鏡面加工の能率と精度とを向上する手段を研究した結果、完成されたものである。

【０００５】

【課題を解決するための手段】前記の課題を解決するために、本発明は、０．１ないし１０重量％の研磨剤と、０．１ないし１０重量％の滑剤と、３ないし４０重量％の潤滑調整剤とを水または油脂剤に分散、混合してなることを特徴とする研磨液を提供する。滑剤としては、雲母、グラファイト、タルク、六方晶系窒化硼素および弗素樹脂の中のいずれか１種または２種以上の微粉が好ましく用いられる。

【０００６】さらに本発明は、研磨剤および潤滑調整剤に、０．１ないし１０重量％の滑剤が添加され、水または油脂剤に分散、混合して研磨液を用い、研磨することを特徴とする研磨方法を提供する。

【０００７】

【発明の実施の形態】本発明を実施の形態例をあげながら具体的に説明する。まず、本発明の研磨液は、研磨剤、滑剤及び潤滑調整剤が、水または油脂剤に分散、混合されたものである。

【０００８】本発明に使用される研磨剤としては、被研磨素材の硬度等により適宜に選択することができる。主に、ダイヤモンド、エメリー、スピネル、アルミナ、酸化鉄、酸化クロム、コランダム、ザクロ石、炭化珪素、ジルコニア、立方晶系の窒化硼素など、通常、研磨剤として使用される高硬度無機物の１種または２種以上の混合物があげられる。

【０００９】また、潤滑調整剤、すなわち潤滑剤兼研磨圧力調整剤として、エチレングリコール、プロピレングリコール、トリメチレングリコール、ポリエチレングリコール、グリセリンなどの多価アルコール；ジエチルアミン、トリエチルアミン、ジエチルアミノエタノール等のアミン類の１種または２種以上の混合物があげられる。

【００１０】さらに、滑剤として雲母、グラファイト、タルク、鱗片状の六方晶系窒化硼素、または弗素樹脂などの１種または２種以上の混合物の微粉があげられる。滑剤の粒度は研磨剤の粒度が小さいほど小さいものが好ましく、通常３００メッシュより粒径の小さいもの、好ましくは５００ないし１０００メッシュ程度である。しかし、滑剤は鱗片状のものが多く、厚さが厚くとも研磨中に薄くなり、最終的に単分子層にまでなるので、平面

形状が若干大きくても使用目的を達成することができる。

【００１１】本発明者は、前記の滑剤を研磨液に添加すれば、被研磨面の研磨剤による擦過傷が防止されるという作用を見出した。さらに、定盤に傷が付いたり、定盤面が変形するのを防ぎ、高精度研磨に効果的作用のあることも見出した。例えば、従来は、数平均粒径（以下、平均粒径は数平均）が１μｍのダイヤモンド微粒子を研磨剤として使用する研磨液と錫定盤とを用いＳｉＣ板を研磨すれば２０分間、平均粒径が０．５μｍのダイヤモンド微粒子を研磨剤に使用すれば１５分間、平均粒径が０．２５μｍ以下では１０分間の研磨が限度であって、それ以上の時間、研磨を続けると定盤に波打ちや変形が発生し、研磨面に擦過傷が発生していた。しかし、滑剤を添加し同様の条件でＳｉＣ板を研磨したところ、平均粒径が０．２５μｍのダイヤモンド微粒子を研磨剤として用い、１２０分間、研磨後において、定盤に波打ちや変形は見られず、研磨面に擦過傷が発生していなかったのである。

【００１２】滑剤の添加にこの様な作用があるのは、何等かの原因で定盤面に微小な波面が形成されると、ＳｉＣやセラミックス等の硬い被研磨面が柔らかい定盤面上を擦りながら移動する際に、硬い被研磨面の端面エッヂが定盤面を削り、削られた定盤の微片に研磨剤が付着し、定盤と被研磨面との間に噛み込まれて定盤面と被研磨面との滑りを妨害し、被研磨面が傷つくものと考えられる。この現象は、シリコンや銅、ステンレス等の金属でも同様に発生しているものと考えられる。

【００１３】従って従来の研磨液を用いると、定盤の再生をその都度、何回も行いながら研磨するので時間も掛かり、しかも定盤面が安定しないので研磨精度も出ないものである。定盤を再生しても、しばらくの間は研磨が安定するが、すぐに定盤面が変形したり、荒れたりするので、又、再生するという繰返しになり、能率的な研磨加工ができず、高精度の鏡面に加工し難いのである。

【００１４】ところで、滑剤が添加されている研磨液では、例えば鱗片状の滑剤が定盤面と被研磨材の端面の間にバリヤーとして介在し、かつ、定盤面と被研磨材とを滑りやすくしているので、端面エッヂが定盤を削り採るようなことが少なくなり、長時間の研磨においても定盤面が大きな変形に至ることはなく、研磨面が傷つけられないものと考えられる。

【００１５】研磨液の各成分の比率は、研磨剤が０．１ないし１０重量％、潤滑調整剤が３ないし４０重量％、滑剤が０．１ないし１０重量％用いるのが好ましい。とくに好ましいのは、研磨剤が０．５ないし２重量％、潤滑調整剤が１５ないし２５重量％、滑剤が０．３ないし２重量％の範囲である。研磨剤が０．１重量％以下では研磨液の研磨機能が低下して効率的でなくなり、１０重量％を超えると研磨剤が部分的に何層にも重なりあって、いわゆる平面が出にくくなる傾向がある。潤滑調整剤は３重量％以下では潤滑保持時間が短くなり、絶えず研磨液を定盤上に注入する必要に迫られる。滑剤が０．１重量％以下になると滑剤を添加する効果を殆ど期待できなくなり、１０重量％を超えれば研磨効率が低下する傾向が見えるようになる。

【００１６】また、従来の研磨液におけるの同様に、仕上研磨で用いるシリカゾルやアルミナゾル、ジルコニヤゾルを少量、本発明の研磨剤に加えて用いても差し支えない。そのほかに界面活性剤、沈降防止剤、増粘剤を加えることもある。増粘剤を加えることにより、スラリー状の研磨液をペースト状にして研磨に用いることも可能である。

【００１７】

【実施例】被研磨素材と定盤とが相対的に、同一平面内で回転とＸＹ軸方向とを同時に移動しながら研磨加工を行うラッピング機を用いて本発明を実施し、その効果を確認したので、以下に例をあげて具体的に説明する。重量％は研磨液中の含有比率を示す。

【００１８】実施例１

表面をＣＶＤ法により調整したＳｉＣ板（８０×８０ｍｍ）を、平均粒径が０．５μｍダイヤモンド微粒子１重量％、１０００メッシュのグラファイト微粉１重量％及びエチレングリコールを２０重量％を水に分散、混合して調整した研磨液と砲金定盤とを用い、６０分間粗研磨した。さらに、前記の粗研磨表面のＳｉＣ板を、平均粒径０．２μｍのダイヤモンド微粒子を１重量％、１０００メッシュのグラファイト微粉を１重量％及びエチレングリコールを２０重量％、水に分散、混合して調整した本発明の研磨液と砲金定盤とを用い、６０分間で研磨し、ついで、同じ組成の本発明の研磨液と錫定盤とを用いて１２０分間、中間で定盤を再生することなく、仕上研磨して表面を鏡面に仕上げた。

【００１９】仕上げた鏡面を顕微鏡で観察したが研磨傷は観察されず、位相測定レーザー干渉計（Ｚｙｇｏ干渉計：キャノン（株）製）で測定した表面粗さＲａは０．４８ｎｍであった。

【００２０】実施例２

実施例１と同様にして粗研磨表面のＳｉＣ板を用意した。このＳｉＣ板の表面を、平均粒径０．５μｍのダイヤモンド微粒子を１重量％、雲母微粉（マイカ＃８０００：脇田工業（株）製）１重量％及びジエチルアミノエタノールを２０重量％、水に分散、混合して調整した本発明の研磨液と砲金定盤とを用い、８０分間で研磨し、ついで、平均粒径０．２μｍのダイヤモンド微粒子を１重量％、窒化硼素（六方晶系）微粉を１．２重量％及びシリカゾル１重量％を水に分散、混合して調整した本発明の研磨液と錫定盤とを用い、１２０分間、仕上研磨して表面を鏡面に仕上げた。前記の研磨中、いずれの工程でも定盤は再生しなかったが問題なく作業を続けること

ができた。仕上げた鏡面を顕微鏡で観察したが研磨傷は観察されず、表面粗さ形状測定器（Ｚｙｇｏ干渉計：キャノン（株）製）で測定した表面粗さＲａは０．５５ｎｍであった。

【００２１】実施例３

直径１２０ｍｍのシリコン単結晶板の表面を鏡面仕上した。まず、一般的に使用されている平均粒径１μｍダイヤモンドスラリーからなる研磨液を用い、前記シリコン単結晶板の表面を粗研磨した。

【００２２】次に、平均粒径０．５μｍのアルミナ微粒子を１．５重量％、１０００メッシュのグラファイト微粉を１重量％及びグリセリンを１８重量％、水に分散、混合して調整した本発明の研磨液と錫定盤とを用い、前記の粗研磨表面のシリコン単結晶板を６０分間研磨し、ついで、平均粒径０．１μｍのジルコニア微粒子を１．５重量％、窒化硼素（六方晶系）微粉を１重量％、シリカゾル１重量％及びプロピレングリコール２５重量％を水に分散、混合して調整した本発明の研磨液と錫定盤とを用い、１００分間、仕上研磨して表面を鏡面に仕上げた。前記の研磨中、両定盤はともに再生しなかったが問題なく作業を続けることができた。仕上げた鏡面を顕微鏡で観察したが研磨傷は観察されず、表面粗さ形状測定器（サーフコム：東京精密（株）製）で測定した表面粗さＲａは０．８２ｎｍであった。

【００２３】実施例４

直径９５ｍｍのハードディスク用アルミニウム合金板の表面を鏡面仕上した。まず、一般的に使用されている平均粒径０．５μｍダイヤモンドスラリーからなる研磨液を用い、前記のアルミニウム合金板の表面を粗研磨した。次に研磨液として平均粒径０．２ｍμのコランダム１．２重量％、タルク微粉１重量％、エチレングリコール２０重量％を水に分散、混合した本発明の研磨液とポリッシングクロス（仕上げ用）で１５分間、仕上研磨した。仕上げた鏡面の表面粗さを、表面粗さ形状測定器（サーフコム：東京精密（株）製）で測定した結果、表面粗さＲａは０．９５ｎｍであった。

【００２４】比較例

実施例１で用意したのと同じ粗研磨表面のＳｉＣ板を、従来の研磨方法を用いて鏡面研磨した。まず、平均粒径０．５μｍのダイヤモンド微粒子を１重量％及びエチレングリコールを２０重量％、水に分散、混合して調整した従来の研磨液と錫定盤とを用いて研磨した。研磨開始後、約１５分経過した時点で定盤の再生が必要になり、使用中の定盤を取り外し、鋳物の定盤上でアルミナスラリーからなる研磨液を用いて約５分間研磨して再生した。この研磨と再生とを３回繰り返した。次に、平均粒径０．２μｍのダイヤモンド微粒子を１重量％及びエチレングリコールを２０重量％、水に分散、混合して調整した研磨液と錫定盤とを用いて研磨した。研磨開始後、約１０分経過した時点で定盤の再生が必要になり、前記と同様に約５分間かけて再生し、研磨と定盤の再生とを繰り返しながら、約１００分間、仕上研磨して表面を鏡面に仕上げた。

【００２５】仕上げた鏡面を顕微鏡で観察したが多数の研磨傷が観察され、表面粗さ形状測定器（Ｚｙｇｏ干渉計：キャノン（株）製）で測定した表面粗さＲａは１．７３ｎｍであった。

【００２６】

【発明の効果】本発明の研磨液及び研磨方法を利用すれば、定盤の再生に要する時間が大幅に短縮して生産能率を向上できるのみならず、定盤が安定し研磨傷が減少して平面粗さ（Ｒａ）を向上することができる。電子業分野をはじめ、これからの光通信、光加工、光医療、高出力レザーや高エネルギー放射光等の技術、学術分野で精密加工に利用することができる。例えば、ＬＳＩ用シリコン、ＶＴＲのヘッド、高出力レーザ用反射鏡などの加工に好適である。

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-181408
(43)Date of publication of application : 06.07.1999

(51)Int.CI. C09K 3/14

(21)Application number : 09-356524
(22)Date of filing : 25.12.1997

(71)Applicant : TERU KAGAKU KOGYO KK
(72)Inventor : YAMAMOTO TSUTOMU
YOSHIDA MASANOBU

(54) ABRASIVE LIQUID AND POLISHING

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain an abrasive liquid for improving efficiency and precision of high-precision mirror-polishing for flat planes having a surface roughness of the order of nanometer or angstrom.
SOLUTION: This abrasive liquid is composed of 1 to 10 wt.% of an abrasive, 0.1 to 10 wt.% of a lubricant and 3 to 4 wt.% of a lubrication modifier, all dispersed in and mixed with water or oil. The lubricant is preferably composed of one or more types of fine powders selected from the group consisting of those of mica, graphite, talc, hexagonal boron untried and a fluororesin. This abrasive liquid is suitable for highly precision mirror polishing for various industrial areas including electronics, mechanics and optics, e.g. for polishing silicon for LSIs, VTR heads and mirrors for high-power lasers.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] Polish liquid characterized by distributing 0.1 thru/or 10% of the weight of an abrasive material, 0.1 thru/or 10% of the weight of lubricant, and 3 thru/or 40% of the weight of a lubrication regulator to water or a fats-and-oils agent, and coming to mix.
[Claim 2] Polish liquid according to claim 1 with which lubricant is characterized by being any one sort or two sorts or more of fines in a mica, graphite, talc, hexagonal system boron nitride, and fluororesin.
[Claim 3] The polish approach characterized by for 0.1 thru/or 10% of the weight of lubricant being added by an abrasive material and the lubrication regulator, distributing and mixing to water or a fats-and-oils agent, and grinding using polish liquid.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the polish liquid and the polish approach of using it for the coloring for forming the smooth side where precision is very high, or medium polish. Front faces, such as the glass used as a mirror plane, aluminum, copper, stainless steel, a ferrite, silicon, silicon carbide, and ceramics, are ground efficiently in more detail, and it is related with the polish liquid and the polish approach of using it in order to form the mirror plane of high degree of accuracy.
[0002]
[Description of the Prior Art] Electronics is begun and the smooth side of NANOMETA or angstrom order came to be required of the concrete target with a very high precision for surface roughness (Ra) in techniques, such as mechanical engineering and optics, and the scientific field by the latest technical progress. The mirror plane is made to most of these smooth sides by polish processing of wrapping and polishing which used the abrasive material, a buff, etc. For example, wrapping which inserts and grinds the polish liquid which distributed abrasive materials, such as a diamond particle and an alumina particle, between the polished surface-ed and the surface plate is raised, using comparatively soft raw materials, such as a pitch, tin, a solder alloy, and a polishing cross, as a surface plate.
[0003]
[Problem(s) to be Solved by the Invention] In the aforementioned wrapping, although the precision of a surface plate sticks a ground raw material front face and a surface plate side and is ground by the initial stage of the polish currently kept high, since a polished surface-ed is hard and the surface plate side is soft, a surface plate side begins deformation gradually with progress of polish. Since the polished surface where precision is high is not processible even if a polished surface-ed stops sticking, polish becomes an ununiformity and it continues the **** polish if a surface plate deforms, polish must once be stopped, a surface plate must be removed and the re-correction (it is called playback) of the front face must be made. Thus, there is nothing with how many times and the activity which resumes installation and polish for the reproduced surface plate as before is repeatedly processed on the target mirror plane. Therefore, although many hours were spent, there were few amounts of polishes, and there was a problem that processing efficiency was bad in it.
[0004] In addition, although what is necessary is just to use an abrasive material with large particle diameter in order to make [many] the amount of polishes per time amount, if particle diameter is large, the scratch by the particle will occur in a polished surface-ed, and since it becomes such a deep big scratch that particle diameter is large, moreover It is necessary for it to be necessary to use an abrasive material with big particle diameter at first, and to grind and remove big irregularity early, and to advance polish, making small particle size of the abrasive material subsequently used gradually, and to grind and blot out the scratch produced by the abrasive material. Long floor to floor time was taken to make the mirror plane of high degree of accuracy for these activities, and processing efficiency was made low. This invention solves the aforementioned problem, and as a result of studying a means to improve the efficiency and precision of mirror plane processing, it is completed.
[0005]
[Means for Solving the Problem] In order to solve the aforementioned technical problem, this invention offers the polish liquid characterized by distributing 0.1 thru/or 10% of the weight of an abrasive material, 0.1 thru/or 10% of the weight of lubricant, and 3 thru/or 40% of the weight of a lubrication regulator to water or a fats-and-oils agent, and coming to mix. As lubricant, any one sort or two sorts or more of fines in a mica, graphite, talc, hexagonal system boron nitride, and fluororesin are used preferably.

[0006] Furthermore, the polish approach characterized by for 0.1 thru/or 10% of the weight of lubricant being added by an abrasive material and the lubrication regulator, distributing and mixing to water or a fats-and-oils agent, and grinding this invention using polish liquid is offered.
[0007]
[Embodiment of the Invention] It explains concretely, giving the example of a gestalt of operation of this invention. First, an abrasive material, lubricant, and a lubrication regulator are distributed by water or the fats-and-oils agent, and the polish liquid of this invention is mixed.
[0008] As an abrasive material used for this invention, it can choose suitably with the degree of hardness of a ground raw material etc. One sort or two sorts or more of mixture of a high degree-of-hardness inorganic substance usually used as an abrasive material, such as boron nitride of a diamond, emery, a spinel, an alumina, ferrous oxide, chromic oxide, corundum, a garnet, silicon carbide, a zirconia, and cubic system, is mainly raised.
[0009] Moreover, one sort or two sorts or more of mixture of amines, such as polyhydric-alcohol; diethylamines, such as ethylene glycol, propylene glycol, a trimethylene glycol, a polyethylene glycol, and a glycerol, triethylamine, and diethylamino ethanol, is raised as a lubrication regulator, i.e., a polishing pressure [lubricant-cum-] force regulator.
[0010] Furthermore, the fines of one sort or two sorts or more of mixture, such as a mica, graphite, talc, scale-like hexagonal system boron nitride, or fluororesin, are raised as lubricant. what has so small that the grain size of an abrasive material is small a grain size of lubricant -- desirable -- what has a particle size usually smaller than 300 meshes -- they are 500 thru/or about 1000 meshes preferably. However, lubricant has many scale-like things, and since it becomes it thin during polish that thickness is thick and becomes even a monomolecular layer eventually, even if a flat-surface configuration is large a little, the purpose of use can be attained.
[0011] this invention person found out the operation that the scratch by the abrasive material of a polished surface-ed was prevented, when adding the aforementioned lubricant in polish liquid. Furthermore, the blemish was attached to the surface plate, or it prevented a surface plate side deforming, and it also found that high-degree-of-accuracy polish has an effective operation. If number average particle size (the following and mean particle diameter are a number average) grinds a SiC plate conventionally using the polish liquid and the tin surface plate which use the diamond particle which is 1 micrometer as an abrasive material, for example, for 20 minutes, In 0.25 micrometers or less, when mean particle diameter used the diamond particle which is 0.5 micrometers for the abrasive material, it was polish for 10 minutes for 15 minutes, and mean particle diameter was a limit, when the time amount beyond it and polish were continued, flapping and deformation occurred in the surface plate, and the scratch had occurred in the polished surface. However, when lubricant was added and the SiC plate was ground on the same conditions, using the diamond particle whose mean particle diameter is 0.25 micrometers as an abrasive material, neither flapping nor deformation was looked at by the surface plate in 120 minutes and after polish, and the scratch had not occurred in a polished surface.
[0012] If a minute wave front is formed in a surface plate side by a certain cause, that addition of lubricant has such an operation In case it moves grinding the surface plate side top where hard polished surfaces-ed, such as SiC and ceramics, are soft The end-face edge of a hard polished surface-ed deletes a surface plate side, an abrasive material adheres to the mote of the shaved surface plate, it is bit between a surface plate and a polished surface-ed, slipping of a surface plate side and a polished surface-ed is blocked, and it is thought that a polished surface-ed gets damaged. It is thought that metals, such as silicon, and copper, stainless steel, have generated this phenomenon similarly.
[0013] Therefore, if conventional polish liquid is used, since it grinds repeatedly, reproducing a surface plate, time amount is also taken, and since a surface plate side moreover is not stabilized, polish precision will not come out each time, either. Since a surface plate side deforms immediately or it is ruined although polish is stabilized for a while even if it reproduces a surface plate, it becomes a repetition of reproducing, and efficient polish processing cannot be performed, but it is hard to process the mirror plane of high degree of accuracy.
[0014] By the way, it is thought that it does not result [in / what an end-face edge shaves a surface plate and takes since scale-like lubricant intervenes as a barrier between the end faces of abrasives-ed / a surface plate side and / with the polish liquid by which lubricant is added, for example, and it is / abrasives-ed / a surface plate side and / slipping-easy and it is carrying out decreases, and / polish of long duration] in deformation with a big surface plate side, and a polished surface is not damaged.
[0015] The ratio of each component of polish liquid has [an abrasive material / 0.1 thru/or that lubricant

uses 10% of the weight 3 thru/or 40% of the weight] a desirable lubrication regulator 0.1 thru/or 10% of the weight. For an abrasive material, a lubrication regulator is [the lubricant of especially a desirable thing] 0.3 thru/or 2% of the weight of the range 15 thru/or 25% of the weight 0.5 thru/or 2% of the weight. If the polish function of polish liquid becomes less efficient [an abrasive material / fall and] at 0.1 or less % of the weight and it exceeds 10 % of the weight, an abrasive material overlaps many layers selectively, and there is an inclination out of which the so-called flat surface stops being able to come easily. At 3 or less % of the weight, the lubrication holding time becomes short and it is pressed for a lubrication regulator by the need of pouring in polish liquid on a surface plate continuously. If lubricant becomes 0.1 or less % of the weight, and it will become impossible to almost expect the effectiveness which adds lubricant and will exceed 10 % of the weight, the inclination for polish effectiveness to fall comes to be in sight.

[0016] Moreover, even if it adds and uses for the abrasive material of small quantity and this invention the silica sol used by coloring, alumina sol, and JIRUKONIYAZORU like the thing in conventional polish liquid, it does not interfere. In addition, a surfactant, a sedimentation inhibitor, and a thickener may be added. By adding a thickener, it is also possible to make slurry-like polish liquid into the shape of a paste, and to use it for polish.

[0017]

[Example] Relatively, since the ground raw material and the surface plate carried out this invention using the wrapping machine which performs polish processing and checked the effectiveness, moving a revolution and XY shaft orientations simultaneously in the same flat surface, they raise an example to below and explain to it concretely. Weight % shows the content ratio in polish liquid.

[0018] Mean particle diameter carried out rough grinding of the SiC plate (80x80mm) which adjusted example 1 front face with the CVD method for 60 minutes using the polish liquid and the gun-metal surface plate which distributed 20 % of the weight in water, mixed 1 % of the weight of graphite fines and ethylene glycol which are 1 % of the weight of 0.5-micrometer diamond particles, and 1000 meshes, and were adjusted. A diamond particle with a mean particle diameter of 0.2 micrometers for the SiC plate on the aforementioned front face of rough grinding Furthermore, 1 % of the weight, It grinds in 60 minutes using the polish liquid and the gun-metal surface plate of this invention which distributed in water, mixed 1 % of the weight and ethylene glycol 20% of the weight, and adjusted the graphite fines of 1000 meshes. Subsequently Without reproducing a surface plate for 120 minutes in medium using the polish liquid and the tin surface plate of this invention of the same presentation, coloring was carried out and the mirror plane was made to the front face.

[0019] Surface roughness Ra which the polish blemish was not observed although the finished mirror plane was observed under the microscope, but was measured with the phase measurement laser interferometer (Zygo interferometer: product made from Canon) was 0.48nm.

[0020] The SiC plate on the front face of rough grinding was prepared like example 2 example 1. For the front face of this SiC plate, a diamond particle with a mean particle diameter of 0.5 micrometers 1 % of the weight, It grinds in 80 minutes using the polish liquid and the gun-metal surface plate of this invention which were distributed and mixed in water and adjusted 1 % of the weight (mica #8000: product made from Wakita Industry) of mica fines, and diethylamino ethanol to it 20% of the weight. Subsequently Coloring of the diamond particle with a mean particle diameter of 0.2 micrometers was carried out for 120 minutes 1% of the weight using the polish liquid and the tin surface plate of this invention which distributed in water, mixed 1.2 % of the weight and 1 % of the weight of silica sols, and adjusted boron nitride (hexagonal system) fines, and the mirror plane was made to the front face. During the aforementioned polish, although the surface plate was reproduced at neither of the processes, the activity was able to be continued satisfactory. Surface roughness Ra which the polish blemish was not observed although the finished mirror plane was observed under the microscope, but was measured by the surface roughness profile and form tester (Zygo interferometer: product made from Canon) was 0.55nm.

[0021] Mirror plane finish of the front face of a silicon single crystal plate with example 3 diameter of 120mm was carried out. First, rough grinding of the front face of said silicon single crystal plate was carried out using the polish liquid which consists of a mean-particle-diameter diamond slurry of 1 micrometer currently generally used.

[0022] 1 % of the weight and a glycerol for the graphite fines of 1000 meshes 1.5% of the weight Next, 18 % of the weight, [an alumina particle with a mean particle diameter of 0.5 micrometers] The silicon single crystal plate on the aforementioned front face of rough grinding is ground for 60 minutes using the polish liquid and the tin surface plate of this invention which distributed and mixed in water and were adjusted to it. Subsequently Boron nitride (hexagonal system) fines 1.5% of the weight for the zirconia particle of 0.1

micrometers of mean diameters 1 % of the weight, Using the polish liquid and the tin surface plate of this invention which were distributed and mixed in water and adjusted 1 % of the weight of silica sols, and 25 % of the weight of propylene glycols to it, for 100 minutes, coloring was carried out and the mirror plane was made to the front face. During the aforementioned polish, both surface plates of both were able to continue the activity satisfactory, although it did not reproduce. Surface roughness Ra which the polish blemish was not observed although the finished mirror plane was observed under the microscope, but was measured by the surface roughness profile and form tester (surfboard COM: Tokyo Seimitsu Co., Ltd. make) was 0.82nm.

[0023] Mirror plane finish of the front face of the aluminum alloy plate for hard disks with example 4 diameter of 95mm was carried out. First, rough grinding of the front face of the aforementioned aluminum alloy plate was carried out using the polish liquid which consists of a mean-particle-diameter diamond slurry of 0.5 micrometers currently generally used. Next, coloring of 1.2 % of the weight of corundum of mean-diameter 0.2mmicro, 1 % of the weight of talc fines, and the 20 % of the weight of the ethylene glycol was carried out to water for 15 minutes as polish liquid by the polish liquid and the polishing cross (finishing) of this invention which were distributed and mixed. As a result of measuring the surface roughness of the finished mirror plane by the surface roughness profile and form tester (surfboard COM: Tokyo Seimitsu Co., Ltd. make), surface roughness Ra was 0.95nm.

[0024] Mirror polishing of the same SiC plate on the front face of rough grinding as having prepared in the example example 1 of a comparison was carried out using the conventional polish approach. First, the diamond particle of 0.5 micrometers of mean diameters was ground using the conventional polish liquid and the conventional tin surface plate which distributed 1 % of the weight and ethylene glycol in 20 % of the weight and water, mixed, and were adjusted. After polish initiation, when about 15 minutes passed, playback of a surface plate was needed, the surface plate in use was removed, and using the polish liquid which consists of an alumina slurry on a cast surface plate, it ground for about 5 minutes and reproduced. This polish and playback were repeated 3 times. Next, the diamond particle of 0.2 micrometers of mean diameters was ground using the polish liquid and the tin surface plate which distributed 1 % of the weight and ethylene glycol in 20 % of the weight and water, mixed, and were adjusted. Playback of a surface plate having been needed, and having applied for about 5 minutes, having reproduced like the above, and repeating polish and playback of a surface plate after polish initiation, when about 10 minutes passed, for about 100 minutes, coloring was carried out and the mirror plane was made to the front face.

[0025] Surface roughness Ra which many polish blemishes were observed although the finished mirror plane was observed under the microscope, and was measured by the surface roughness profile and form tester (Zygo interferometer: product made from Canon) was 1.73nm.

[0026]

[Effect of the Invention] If the polish liquid and the polish approach of this invention are used, the time amount which playback of a surface plate takes is shortened substantially, and it not only can improve production efficiency, but a surface plate can be stabilized, a polish blemish can decrease and it can improve flat-surface granularity (Ra). It can use for precision processing in techniques, such as future optical communication, optical processing, optical medical care, a high power leather, and high energy synchrotron orbital radiation, and the scientific field, including the electronic business field. For example, it is suitable for processing of the head of the silicon for LSI, and VTR, the reflecting mirror for high power laser, etc.

[Translation done.]